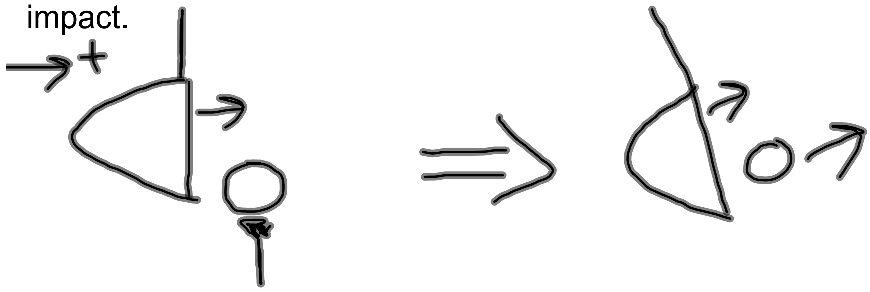
HW: p. 209: 1 – 4

High-speed stroboscopic photographs show the head of a 215 g golf club traveling at 55.0 m/s just before it strikes a 46 g golf ball at rest on a tee. After the collision, the club travels (in the same direction) at 42.0 m/s. Find the speed of the golf ball just after impact.



$m_c = 0.215\ kg \quad \bar{V}_{ci} = 55\ m/s \quad \bar{V}_{cf} = 42\ m/s$

$m_b = 0.046\ kg \quad \bar{V}_{bi} = 0\ m/s \quad \bar{V}_{bf} = ?$

$$m_c v_{ci} + m_b v_{bi} = m_c v_{cf} + m_b v_{bf}$$

$$v_{bf} = \frac{1}{m_b}\left[m_c v_{ci} - m_c v_{cf}\right]$$

$$= 60.76\ m/s$$

Impulse-Momentum Theorem:

$$\bar{F}\Delta t = \Delta \bar{p}$$

impulse — change in momentum

$$\bar{J} = \bar{F}\Delta t$$

↳ impulse

Force ≡ something to change the motion of an object

Force is measure in newtons (N)

$$1\ N = 1\ kg \cdot m/s^2$$

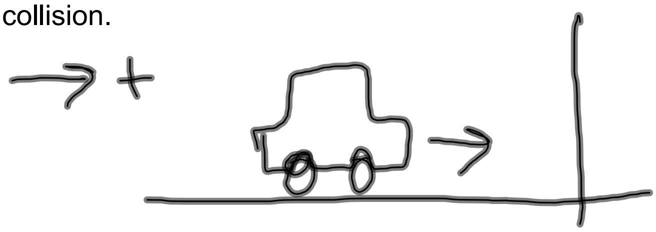
Another way to write impulse-momentum thm.

$$\bar{F}\Delta t = m\Delta \bar{v}$$

$$\bar{F}\Delta t = m(\bar{v}_f - \bar{v}_i)$$

Impulse Momentum Notes and Practice Problems 2.7.12 Honors Physics

A 1400 kg car moving eastward with a velocity of 15 m/s collides with a utility pole and is brought to rest in 0.30 s. Find the force exerted on the car during the collision.



$m = 1400\text{ kg}$ $\Delta t = 0.3\text{ s}$

$v_i = 15\text{ m/s}$

$v_f = \emptyset\text{ m/s}$

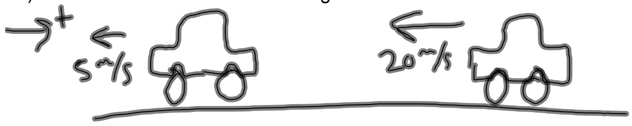
$$F\Delta t = m(v_f - v_i)$$

$$F = \frac{m(v_f - v_i)}{\Delta t}$$

$$= \frac{(1400\text{ kg})(\emptyset\text{ m/s} - 15\text{ m/s})}{(.3\text{ s})}$$

$$= -70\,000\text{ N}$$

A 2240 kg car traveling to the west slows down uniformly from 20 m/s to 5 m/s.
a) How long does it take the car to decelerate if the force on the car is 8410 N to the east?
b) How far does the car travel during the deceleration?



$v_i = -20 \text{ m/s}$ $\quad m = 2240 \text{ kg}$

$v_f = -5 \text{ m/s}$

a) $F = +8410 \text{ N}$

$$F\Delta t = m(v_f - v_i)$$

$$\Delta t = \frac{m(v_f - v_i)}{F}$$

$$= \frac{(2240 \text{ kg})[(-5 \text{ m/s}) - (-20 \text{ m/s})]}{8410 \text{ N}}$$

$$= 4.00 \text{ s}$$

b) $$a_x = \frac{v_f - v_i}{\Delta t}$$

$$= \frac{-5 \text{ m/s} - (-20 \text{ m/s})}{4 \text{ s}}$$

$$= 3.75 \text{ m/s}^2$$

$$\Delta x = v_{ix} t + \frac{1}{2} a_x t^2$$

$$= (-20 \text{ m/s})(4 \text{ s}) + \frac{1}{2}(3.75 \text{ m/s}^2)(4 \text{ s})^2$$

$$= -50 \text{ m}$$